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ABSTRACT

A study investigated whether students' abilities to solve verbal analogy problems can be increased through teacher-generated direct instruction and whether increased ability in solving verbal analogies is directly related to increased reading comprehension ability. Subjects, 90 children (30 from fourth, fifth, and sixth grades), participated in either a treatment or a control group condition. Teachers of treatment groups had participated in a two-day inservice workshop dealing with the nine categories of verbal analogies developed in previous studies and with possible teaching strategies for solving verbal analogy problems. Treatment group teachers spent approximately 30 minutes each week on verbal analogies instruction from October through March. Results indicated that direct teacher generated instruction does appear to increase students' ability to reason analogically, but that the relationship between this ability and increased reading comprehension scores was not statistically significant except when the data from individual groups were combined to form two large groups. In this case, all correlations were statistically significant on both pre- and posttest assessments, suggesting that analogical reasoning is an important component of reading comprehension. (Tables of findings are included.) (EL)

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Analogical Reasoning and Reading Comprehension in Grades 4, 5, and 6: A Continuing Study of Relationships

Nearly seventy years ago, Thorndike (1917) concluded that reading is reasoning, and in the intervening years various explanations of the reading-reasoning process have been advanced. Exactly what the relationship between reading and reasoning may be has never been clear. In recent years, reading researchers and theorists have favored cognitive explanations of the reading comprehension process. Rumelhart and Ortony (1977) have suggested that in schema theory the entire comprehension process may be regarded in terms of analogical reasoning: "When we determine that a situation fits a certain schema, we are in a sense determining that the current situation is analogous to those situations from which the schema was originally derived."

CS 008 293

Tierney and Cunningham (1984) noted the scarcity of research studies dealing with the use of analogy in reading comprehension instruction despite the common assumption of many classroom teachers that "...while explanation via analogy is not a substitute for experience, it affords a practical means for introducing students to unfamiliar information in the context of a familiar framework." However, such an assumption would seem to rest upon pupils' abilities to solve analogical reasoning problems.

To study the relationships between children's analogical reasoning ability and their reading comprehension Cramer, Pascarella, and Hendress (1980) constructed an "easy-word" verbal analogies instrument and found it to be a valid and reliable predictor of reading comprehension. A major conclusion of this study was that even though a child had no difficulty in decoding the "easy words" of the analogies test, it did not necessarily follow that the child could reason analogically with those words. Further, it was established that without direct instruction the analogical reasoning ability of children in grades 3 through 8 appeared to be developmental in nature, increasing with age and grade level (Cramer & Hendress, 1981).

As part of a continuing investigation of the relationships between analogical reasoning and reading comprehension, this study investigated two questions: (1) Can students' abilities to solve verbal analogy problems be increased through teacher-generated direct instruction? and (2) Will increased ability in solving verbal analogies be directly related to increased reading comprehension ability?

METHOD

Subjects

Ninety children, 30 fourth graders, 30 fifth graders, and 30 sixth graders from a public school in Bureau County Illinois participated in this study. They were predominantly children of White, middle-class parents living in a small rural community.

Materials

Analogical reasoning ability was assessed with the Verbal Analogies-3 (VA-3) Test, a specially constructed "easy word" verbal analogies test across nine categories, found to be valid and reliable in previous research (Cramer & Hendress, 1981). Raw scores from the 70 items were used in all data analyses.

Reading comprehension was assessed with the SRA Reading Achievement Test, Forms E and F. Again, only raw scores were used in data analyses.

Treatment

Three treatment and three control classrooms (two from each grade 4, 5, and 6) were selected randomly from among teachers volunteering to participate in the study. Teachers of treatment group classes were participants in a two-day inservice workshop dealing with two main topics: (1) the nine categories of verbal analogies developed in previous studies: contrasts/opposites, quantative, similarities/synonyms, class membership, class naming, part-whole, functional, conversion/predication, and word pattern; and (2) possible strategies for teaching students to solve verbal analogies problems: practice, student-generated analogies, and mental imagery strategies. The workshop was held in early summer, prior to the beginning of the study to permit teachers time to prepare plans for analogies instruction the following fall.

Teachers of control group classes were not workshop participants and were asked to teach reading the as they had done in past years. They were informed that for this study their pupils would participate only in pre- and posttesting, but that information about results would be shared completely with them upon completion of the study.

Initial testing was conducted in the first week of October; post-testing in the last week of March. During the intervening portion of the school year, treatment group teachers spent approximately thirty minutes of classtime each week on verbal analogies instruction. All used a combination of methods involving practice sheets, student-generated analogies in the nine categories, and some mental imaging procedures in which pupils were asked to mentally manipulate the elements of analogies constructed by other pupils in order to solve the problem. One standard feature of treatment instruction was that analogies were always presented in the format A is to B, as C is to D. Teachers of treatment classes reported that they made no direct references to the use of analogies as an aid to comprehension.

Data Analysis

From each treatment and control class, 15 subjects were selected randomly for pre- and post-test t-test comparisons of raw scores on the VA-3 test and the SRA Comprehension test. Teachers were not informed as to which students in their classes were to be subjects of the study. Correlation coefficients between students' scores on the VA-3 test and SRA Comprehension test were calculated for each grade level and for the entire group. The .01 level of statistical significance was employed as the criterion for each comparison.

RESULTS

On comparisons of initial scores between verbal analogy instruction groups and their control group counterparts at each grade level, there were no significant differences on either the VA-3 test or the SRA Comprehension test. When all subjects were considered, there was no significant difference on initial scores between treatment and control subjects.

On the VA-3 test, each verbal analogy instruction group scored statistically significant gains from the pre- to the post-test ($p=<.001$ for each comparison.) Of the control groups, only the 4th grade group gained significantly over its initial mean score ($t=3.39$, $df=14$, $p=<.005$). When all subjects were considered, those receiving verbal analogy instruction scored significantly higher than the control subjects ($F(1,88)=19.29$, $p<.000$).

On the SRA Comprehension test, each treatment group and each control group made statistically significant gains on post-test scores over initial scores ($p=<.000$ for all comparisons, except for the 6th grade control group for which $t=2.84$, $df=14$, $p=<.013$).

Correlation coefficients between students' scores on the VA-3 test and SRA Comprehension test for each grade level and for the combined groups (analogies instruction and control group) are shown in Table I for ease of reference.

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Insert Table I About Here

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DISCUSSION

The two main questions posed in this study appear to be at least partially answered. The first question asked: Can students' abilities to solve verbal analogy problems be increased through teacher-generated direct instruction? After nearly a full school year of teacher-generated instruction all pupils in the 4th, 5th, and 6th grade treatment groups increased significantly in their ability to solve verbal analogy problems. Direct, teacher-generated instruction in verbal analogical reasoning does appear to increase 4th, 5th, and 6th grade students' abilities to solve "easy word" analogies. Given subjects in the normal range of intelligence and experienced classroom teachers willing to "try something new," this is not a startling finding. However, it is comforting to know that with direct instruction by concerned teachers who are knowledgeable about various categories of verbal analogies, pupils at the middle grade levels will significantly increase their ability to reason analogicall, and that pupils not receiving such instruction do not.

The second main question posed in this study asked: Will increased ability in solving verbal analogies be directly related to increased reading comprehension ability? This question is only partially answered in the affirmative. All students in both the analogies instruction treatment groups and in the control groups scored significantly higher on the reading comprehension post-tests than they did on the initial assessment. Thus, there was no clear advantage to subjects who had participated in the verbal analogies instruction. Though treatment subjects' scores tended to be higher than their control group counterparts, there was not a statistically significant difference.

What is most interesting is the shift upward to statistically

significant correlations between performance on the VA-3 test and the SRA Reading Comprehension test for each group of subjects who had participated in the analogies instruction, with no comparable shift in the same relationship for groups who had not participated in the treatment. (See Table I.) Also, when data from individual groups were combined to form two large groups (Analogies group, n=45; and Control group, n=45) all correlations were statistically significant on both pre- and post-test assessments. This finding is consistent with our previous study (Cramer & Hendress, 1981) suggesting that analogical reasoning is an important, and perhaps developmental, component of reading comprehension whether or not students have received direct instruction in verbal analogical reasoning. Although, the teachers of the verbal analogies treatment groups did nothing in their teaching to suggest to the students that analogies instruction was related in any way to reading comprehension instruction, nevertheless, the analogies scores were correlated with comprehension scores at a dramatically higher level for the two post-test scores than for the pre-test scores.

At least two lines of further study seem warranted by these findings. First, the categories of analogies used in the instruction of the three treatment groups need considerable analysis to determine which, if any, contribute most to an increase in reading comprehension scores. If it could be determined that some categories are more powerful than others, then particular attention to those categories during clasroom instruction would appear to be useful. Then, specific passages containing specific types of analogies could be constructed or located for students to use in developing their ability to follow analogical reasoning when embedded in

prose.

Second, much more attention must be given to specific instructional strategies. This study was limited in that each analogy-treatment group teacher used a combination of strategies during instruction, thus confounding any analysis of which type of instruction was most beneficial. Finally, on the basis of this study, it would seem useful to pursue suggestions set down by Tierney and Cunningham (1984) with certain provisions. Future research could be designed to provide students with analogies in the texts they read, and students could be systematically trained to create their own analogies, provided that such studies are conducted under ecologically valid classroom conditions and that some attempt is designed to assess whether or not students transfer instruction in analogical reasoning to their normally assigned reading tasks.

TABLE I

Correlation Coefficients between for Scores on Verbal Analogies-3 Test and SRA Comprehension Test for 4th, 5th, and 6th Grade Analogies Instruction and Control Groups

Group	Pre-test R	Post-test R
4th Grade Treatment (a)	.42	.66*
4th Grade Control	.56	.51
5th Grade Treatment	.31	.78*
5th Grade Control	.53	.59
6th Grade Treatment	.14	.72*
6th Grade Control	.47	.49
Combined Treatment Groups (n=45)	.53*	.78*
Combined Control Groups (n=45)	.61*	.52*

* p = < .01

(a) N=15 for each Treatment and Control Group

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